DOCUMENT RESUME

ED 271 018 FL 015 783

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TITLE Adjectives, Nouns and Copredication in English.
PUB DATE Apr 84
NOTE 30p.; In: Proceedings of the Annual Linguistics Conference (3rd, Irbid, Jordan, April 1-3, 1984); see FL 015 768.
PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Adjectives; *English; Grammar; *Nouns; *Semantics; Structural Analysis (Linguistics)
IDENTIFIERS *Predicates

ABSTRACT

Analysis of the cofunctional relationship between common nouns and adjectives in English is examined in terms of the principle of semantic copredication. It is proposed that a formalized semantic metalanguage system can be constructed to demonstrate that some English adjectives behave like common nouns. Numerous examples are provided throughout the paper. (MSE)

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ADJECTIVES, NOUNS AND COPREDICATION IN ENGLISH

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Adjectives, Nouns and Copredication in English

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I Introduction

1.1 The principal aim of this paper is to make explicit the cofunctional relationship between adjectives and common nouns in English in terms of semantic copredication. The notion is not new: Quirk, in the celebrated work A Grammar of Contemporary English, uses the term "co-reference" to refer to the relationship between the noun 'daughter' and adjective 'pretty' in the sentence: "Your daughter is pretty."[1] W.P. Lehmann (1963) uses the term "compound references" to refer to the elements in the phrases "green roofs," "green dresses," etc.[2]

The idea could also be traced back through Strawson, Geach, Lyons,[3] Reichenbach,[4] and Leibniz back to Plato himself.[5] However, since it is not the main purpose of this paper to trace the developments of adjectives and nouns as word-classes, I shall simply refer the reader with further interest along this line to the references below and the bibliography at the end of this paper.

Although these scholars, and indeed many others, have briefly mentioned or suggested the line of argument, very *little* work - one that could be considered a substantial presentation - has been done in this field. Richard Montague mentions - perhaps with a suggestive overtone of completeness - in his "Universal Grammar" that "indications" of how to treat adjectives are given in his "On the Nature of Philosophical Entities," (1960,1967), while in reality he gave a more generous treatment in "English as a Formal Language" (1970).[6] But even in the latter, the treatment was indeed thinly veiled against the backdrop of other philosophical topics.

J.A.W. Kamp, in 1973,[7] gave a paper at the Cambridge Colloquium on Formal Semantics of Natural Language entitled "Two theories about adjectives." The paper, at first glance, purports to advance a theory on adjectives; but, so it seems, the author in the final analysis turns around and concentrates his attention on two issues: one is to repair some of Montague's formulas which have been generally recognised as inadequate in dealing with a certain group

of adjectives - namely, one that includes 'alleged', 'former', etc.[8]; the other to answer the group of philosophers who believe that positive adjectives stem from comparative sources.

1.2 The underlying intention of this essay is to demonstrate in a simple straight-forward manner that a formalized semantic metalanguage system could be built up - one, perhaps, not as "ritualistically" complicated as that (or those) proposed by most Montagueans - to show that English adjectives (though not all) do behave like the common nouns, and that the justification for this procedure will gradually unfold itself with the progress of the presentation. But first clarification of some terms and concepts must be stated - even if only for convenience.

The terms predicate and predication themselves are usually prone to confusion, perhaps because of their long history of usage. From a semantic viewpoint, Lyons (1977) has this to say:

> ...a predicate is ...a term...used in combination with a name in order to give some information about the individual that the name refers to: i.e., in order to ascribe to him some property...[9] *[Italics mine]*

Quine (1960) defines predicate - in a traditional sense, perhaps - as a "general term," and what Lyons calls "name" a "singular term"; and that predication a process of combining the two "to form a sentence that is true or false according as the general term is true or false of the object, if any, to which the singular term refers."[10] Hodges (1977) on the other hand defines "predicate" as "a string of English words and individual variables, such that if the individual variables are replaced by appropriate designators, the the whole becomes a declarative sentence with these designators as constituents," [11] with an added comment that "predicate" *[in boldface]* "is often used by grammarians and philosophers in ways which are at variance with the definition we have given. For example, some people use the word to mean property or quality."[12]

Strangely enough, Hodges' view seems to coincide with Quirk's - compare Quirk's diagram on page 35, (op.cit.), except that Quirk appears to have given more prominence to the concept of predicate than predication, and that his diagram should be construed from a syntactic viewpoint.

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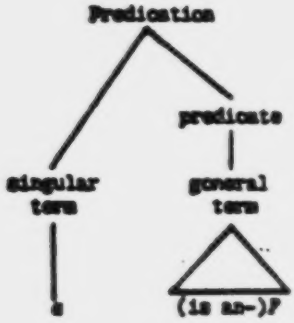
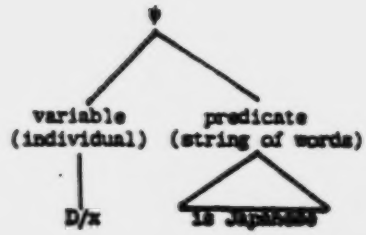
All the alleged variance in these definitions - at least as proclaimed in Hodges' statement - can indeed be reconciled once the statements are schematically represented in some form;[13] compare the following tree-diagrams:





where 'D' is an appropriate "designator", and D = Mr. Washimoto; and '/' indicates a process of replacement.

Diag. A

Diag. B

It is obvious that Diagram A represents Quine's concept of predication, and that B Hodges'. Normally, Quine would represent the notion either as "a is (an) *F*" or simply "*Fa*"; and in general so does Hodges, e.g., "Ja".[14]

For our purposes, then, we shall define predicate - in the usual, traditional sense - as a term that refers to *a property (quality, or state) which could be appellative of some individual name(s)*; and copredication as simply *a process of combining two predicates*, usually from two different sources - e.g., an adjective and a noun, or a noun and a noun, etc., through a commonly accepted well-formed procedure. For example, we could think of 'a tall man' as "something is tall & something is a man," and that "something" is one and the same entity. With the aid of symbolic notations, the phrase could be formulated more simply:

el.1 (Tx & Mx)

using the obvious abbreviations 'T' and 'M' to stand for the predicates. This is indeed a very simple example brought in to render added clarity to the definitions at hand. In reality, however, the process can be quite complicated -

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compare, for example, a 'house-boat' and a 'boat-house'.

Other concepts of opaque nature will be defined, or clarified, where and when necessary.

1.3 Since, of necessity, there is a limit on the length of the essay, and since the subject as proposed here is, by nature, extensive in dimensions, the scope of the paper must accordingly be tailored. Consequently, only the major aspects will be dealt with, although some suggestions on related topics may be given in terms of a theoretical extension to be developed later, or elsewhere.

The nature of the subject-matter may dictate that the paper should deal at least with two aspects of predication: one from the common noun source, the other the adjective. The former generally does not present a great deal of problems, as the common nouns have almost always been a natural source from which scholars, ancient or modern, draw their predicates. It is the latter, however, that has raised questions and doubts as to the nature of its "true" category, and has indeed become a source of controversies even today. Reichenbach, for example, prefers to group "adjectives" with "verbs": "The separation of nouns from the two others [adjectives and verbs] can be justified in so far as the noun can be interpreted to indicate the class for which the predicate holds...The division into adjectives and verbs, however, is of questionable significance."[15] In fact, he went on to say: "...it is better to put the adjective on a par with a tense of a verb."[16]

Quine (1952), on the other hand, wishes to have no distinction between nouns and adjectives at all;[17] and in his later work (1960) he adds "verbs" to the group and calls them all "general terms."[18] Other formalists would like to think of the adjective as part of an intransitive verb, once coupled with a copula, since it conveniently forms, in most cases, a one-place predicate.[19]

From this viewpoint, therefore, we will devote our attention mainly to the adjectives, and let the nouns conduct themselves within the accepted decorum.

In terms of *co*predication, however, the problem is not as grave as it appears, once the formal system is set up. For, indeed, whether we want to predicate an individual-name from an adjective source, e.g.:

s1.2 He is famous

or from a common noun source:

s1.3 He is a pianist

the symbolic representation would have the same underlying structure, i.e., 'Fx', and 'Px' respectively; and these two predicates can easily be combined - under the conditions that satisfy the rules of the system:

s1.4 (Fx & Px)

except that in this particular case, the combination happens to raise a question - of a different kind, i.e., one of semantic ambiguity: "Is the person in question a famous pianist, or is he famous and a pianist (as in the case of Dudley Moore)?" We will glance at adjectives of this kind again later.

II Nomen Adiectivum

2.1 From a syntactic viewpoint, adjectives have been elaborately classified by various scholars. Quirk, again, classifies them in terms of syntactic functions - although he points out some features overlapping with other word-classes in terms of form. For him, the adjectives that can function as both "attributive" and "predicative" are called central, and those only as one or the other peripheral.[20] Such terms would be convenient for a system that contains a cross-reference procedure between syntax and semantics - as one that Montague proposes in "Universal Grammar" or PTQ.[21] Although we have no intention to meddle with such procedures, we will adopt the terms for other purposes - cf. infra.

Thomson and Martinet - henceforth referred to as simply Thomson (1980), give the following classes as the "main kinds of adjectives":[22]

1 of quality: square, good, golden, fat, ...
2 demonstrative: this, that, these, those
3 distributive: each, every, either, neither
4 quantitative: some, any, no, few,...
5 interrogative: which, what, whose
6 possessive: my, your, his, ...

These classes, obviously, must be reclassified before they can be utilized in our system, since some items such as 'each', 'every', 'some', 'any', etc. must be considered quantifiers, while others, such as 'no', 'either (or)', 'neither (nor)' etc. are clearly logical operators, and so on. It appears that no existing syntactic classification would effectively serve our purpose, and that we should do well to reorganize the adjectives as a whole into the following schema:[23]

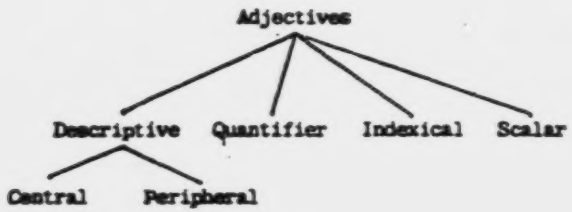

Fig.1

These categories are by no means intended to be watertight compartments as it were. Some doubtless will overlap - in the sense that some members of one category will also belong to another. But this we will examine later. At this point, let us look at what they all mean.

'Descriptive' may be accused of being so general a term, since most, if not all, adjectives (henceforth 'A', and used when appropriate)[24] are descriptive in one way or another; and it may, indeed, be argued that Lyon's term "ascriptive" (cf. supra - §1.2) is much more appropriate. For those who prefer the latter could do so without changing the intended meaning of the term above.

Under this rubric, we deposit two large classes of English adjectives - the central and the peripheral. As a time-saving device, the term "central" is quite convenient, i.e., once the underlying principle as explained by Quirk is understood, the reader will find no difficulty in identifying the items in a dictionary, thus enables us to eliminate the necessity for a special listing. The term "peripheral", however, is here adopted for different reasons, since we do not have the same problems as Quirk does.

In formal semantics - at least from our point of view - it matters not whether the adjective is used in an attributive or a predicative position syntactically; the transformation into a symbolic notation - at least for a one-place predicate - will always be in the same way, i.e., a Predicate-name + an Argument-name. Besides, before the transformation can take place, the expression usually undergoes a paraphrasing process - e.g., an expression such as 'awake' or 'asleep' would be paraphrased as - or semantically approximated to - "in-a-waking-state", or "in-a-sleeping-state", or something similar to to it; and whether one uses 'A' (= awake) or 'W' (= in-a-waking-state) as the predicate, i.e., 'Ax' or 'Wx', it is immaterial.

The term peripheral, for our purposes, is brought in merely to signal a warning that the underlying structure of the adjective in question requires a close examination. For instance, Quirk - again, to resort to his work - gives a phrase

s2.1 a really alive student

as an example of an *a*-A (adapting Quirk's notation here) that can be used as an attributive adjective (abbreviated A-N, where necessary) to mean a "lively" student. Compare the above phrase with the following:

s2.2 She is still alive

Here both phrases 'still alive' and 'really alive' would produce the same underlying structure, e.g.,

s2.3 X + *a*-A

where 'X' is an appropriate modifier. (In fact, for our demonstration here, the underlying form could be simply: 'X + A')

If Quirk's interpretation of s2.1 is correct - and I have no doubt that it is, then the copredication process of this particular instance would

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go through a test case - projecting ourselves into the development of the next section for a moment - i.e., we can say that

s2.4 x is lively & x is a-student[26]

while

s2.5 x is still & x is alive

would yield a negative result; for one thing, the analysis unwittingly turns 'still' into an A, while in the original statement a modifier - in this case an adverb (ADV). Yet, there is no way to leave it out - even though our analysis here focuses only on adjectives - and to retain the complete meaning of the statement. From this viewpoint, then, we will have to channel the predicate 'alive' (of s2.5) to another category, namely, indexical for reasons to be stated.

At this point, one may raise a question: "Are we splitting the same adjective into different lexemes at will to suit our convenience?" The answer is "No!", since the categories proposed above are NOT ontological but functional in nature.

2.2 Before we leave the central and peripheral categories, let us examine very briefly the nature of the predicates that pose some problems, such as 'famous' in 'a famous pianist'. An earlier analysis (s1.4) has shown that

s1.4' (Px & Px)

can generate at least two readings: one "a famous pianist"; the other "someone is famous and he is a pianist," again, as in the case of Dudley Moore. Indeed, most people know and remember Mr. Moore as a well-known actor and comedian, and very few know that he is also an accomplished pianist - at least in US. In general when the expression of this sort is used, the first reading is intended, which indicates that the use of the adjective - in this particular case - depends almost entirely on the use of the noun - i.e., if the person had not been a pianist, he might not have become famous at all; in fact, the usage clearly indicates that.

Quirk mentions a class of "non-inherent" adjectives which at first glance appear to be close to what we are talking about here. At a closer look, however, one cannot say that someone's 'woodenness' or 'being wooden' - from the example "a wooden actor" - was caused by the fact that he is an actor, while it is so in the case of 'a famous ...' Quirk gave other examples of this type, but none parallel.[27]

The unfortunate word "cause" that we have been applying - for lack of a better term - to this type of predicative relationship might sound objectionable to some readers. We could, perhaps, think of this type of copredication in terms of dependency relationship - not so much in the sense of the Dependency Grammar, but in the general sense[28] - i.e., the semantic interpretation of one predicate depends on the other, in this case that of the modifier depends on the head. And if this is a more plausible explication, then we can dub the adjectives of this type pensile *[< L pensilis]*;[29] otherwise, they would take the name central as explained earlier.

2.3 The notion of quantifiers is familiar to most people, so I will be brief. Not all the quantifiers are expressed in the form of adjectives, as we shall see. But first let us modify the quantifier node of the tree-diagram in Fig. 1; the node was given there without its branches:

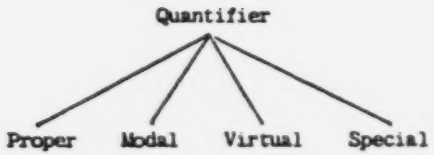

Fig. 2

The quantifiers referred to here are only those capable of assuming a role as such in a semantic interpretation, or those that can be fitted into a quantificational scheme in a formal system. There are terms or expressions that may be considered "quantifiers" from a syntactic viewpoint (cf. Quirk's §4.25f, Op.cit), which will not be dealt with here.

Let us look at the following list:

1 All, any, every, each, ...
2 Some, at least one, ...
3 It is possible that.../necessary that...
4 (All) those and only those...

It will be recognized that (1) fits into the schema of the universal quantifiers; (2) the existential; (3) the modal; and (4) the virtual class or abstraction quantifiers. There are many other expressions that would probably

fit into these quantificational schemata, but these are the typical, and enough to bring back the memories of what we had learned in the dusty past. Some expressions, however, may appear like quantifiers, but semantically they may function as something else, e.g.:

s2.6 Everybody who is nobody goes to Roxy on the Strip to try to meet everybody who is somebody, who, hopefully, could help him get a break in showbiz.

The special (or occasional) type are any quantifiers that have not been mentioned so far; they could be a combination of the types mentioned earlier, e.g., as expressed in 'at least (two/...)', 'at most (twelve/...)', etc.; or those not as commonly used as in the Theory of Possibility that Rescher recently proposed, e.g.: '$(\phi)_A$' for "the x's whose actual property is ϕ," which is in fact an abbreviation for '$(x:\phi x)$'; or '$(\phi)_N$' for '$(x:\phi!x)$' - i.e., "those x's that ϕ is an essential property of," etc.[30]

2.4 The term "indexical" has been proposed by Montague, but then again as Thomason (obliquely perhaps) and other scholars - such as R.M. Martin, and Hintikka[31] - have suggested that most of Montague's ideas are rarely original with him; it was the novelty in the presentation that Montague aimed at.

Montague gave "former" as an example of indexical adjectives; but obviously many more - e.g., 'late' as in 'the late president', 'previous', 'last', 'yesterday' as in 'yesterday afternoon' - can fit into this category. They are indexical because they usually require some kind of markings indicative of something - place, time, or degrees of something else. For example, 'a former president' may be analyzed in a simplified fashion thus:[32]

s2.7 x is a-President-at-Time-t_1, & it is not the case that x is a-President-at-Time-t_2

where t_1 is prior to t_2 (as well as to the time of utterance)

There are also interrelationships among predicates of this type, e.g., the predicative relation of the 'late president' would be subsumed[33] in that of the 'former', etc. Also, like other groups of predicates, the analysis can become complex, e.g., 'a former student' could be either a one-place or two-place predicate depending on its use. And, as usual, this group of adjectives would also overlap those of the quantifiers, as in the cases of 'main argument', 'principal achievement', or 'likely event', etc. In fact, the latter group of

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adjectives require both kinds of analysis - as I demonstrated in a preliminary version (the proposal) of this paper.

2.5 Before a meaningful discussion of scalar adjectives could be made, a basic but necessary concept must be mentioned. In recent years, there has been a development in semantic interpretation of the formal system, probably in an attempt to resolve the differences between the underlying philosophy of the various schools of thought, e.g., the Classical, the Realist, the Formalist, the Intuitionist, etc. Out of all this comes the notion of weak and strong reading. The quickest and simplest way to demonstrate what the concept means is to look at the underlying notion of the logical disjunction (or alternation).

In general, when people think of a statement of the form 'A v B', they think that only one of the components should be true for the whole statement to be true, and not both at the same time. For example, when a mother asks her child if (s)he wants an orange or a banana, she expects the answer to be a choice of one and not both at the same time (of course, the child may say "both" in any case). This usual expectation is commonly considered a strong reading of the statement. The logician, on the other hand, usually allows the following truth-value:

a2.8

A	v	B
T	T	T

This is a weak reading.

2.6 A scalar adjective is one that can be made into a comparative form. At this point, one may protest: "But most adjectives are susceptible of comparative forms!" The comparative form referred to here is of a special kind. To see this clearly, let us consider the following situation: let us say that John at the age of 16 was nice and slim as he was a keen athlete; at 20 his friends began to feel that he was fat; at 26 he got fatter, at 30 he was even fatter, at 36 he was fatter still, and at 40 he was very, very fat, and so on.

Here we see that the same adjective applies to the same person (or entity) in a climbing scale. The following and many like them are capable of behaving like the example above, and hence considered scalar adjectives: funny,

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happy, heavy, expensive, unpleasant, etc.

Not all adjectives are capable of this type of a scaling pattern - e.g.: daily, monthly, quarterly (?), two-legged, four-wheeled, etc. Some logicians would like to regulate the everyday speech in such a way that the following words are not used as scalar predicates at all: square, perfect, smooth, silent, straight - as in 'a straight line'. Perhaps, there is something to be said for this wishful thinking after all; for example, if it can be asserted that AB is a straight line - i.e., already a straight line, how is it possible that it can be a straighter line under any circumstance?

What we have discussed so far could be considered a strong-reading of the concept of the scalar adjective; a weak-reading would probably produce an interpretation that includes all the adjectives which Quirk calls "gradable".

III Predication and Coprodication

3.1 Under the current pressure, i.e., space - and perhaps time as well, the intended formalized metalanguage system as stated in §1.2 could not possibly reach a fully-fledged stage. However, if a substantial amount of common knowledge about the formal system can be assumed, then perhaps more could be accomplished without much ado. And it is in this manner that I will introduce a formalized system here.

3.2 Conceptually, many familiar theoretical points may be left unsaid, but a notational system should at least be indicated; and for convenience, we shall call our system SMI from a "Semantic Metalanguage based on (Objective) Intensions" - objective in the sense that, semantically, we will adhere to the general use of expressions and not follow any of the subjective use of language.[34]

The syntax of SMI will be referred to as 'S', whose language is 'L'. L contains a number of well-formed sentences, or sentence schemata, whose instances are sentences in object or natural languages - sometimes referred to as '$L_{o_1}, \ldots, L_{o_n}$'.[35] L also contains a number of propositions, $p_1, \ldots, p_n$, which may or may not be of the same number as that of the sentences.

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In specifying the syntactic elements of $\mathcal{B}$, we will assume all that is commonly used in a formal system based on the classical two-valued logic, in particular in the Peano-Russellean tradition, and state very briefly the following:[36]

i) 'A, B, C,...' will represent logical formulas, or sentential schemata in $\mathcal{L}$;[37] 'x, y, z,...' and 'a, b, c,...' individual variables and constants respectively.

ii) 'P, Q, R,...' will be predicate constants, or variables - as the case may be - of degrees to be specified in specific contexts. In general, we will use the obvious, or mnemonic, upper-case letters for predicates, e.g., 'M' for man (one-place), 'L' for love(s) (two-place), or 'G' for give(s) (three-place), etc.

iii) The following logical connectives and prefixes will be adopted with all their conventions: '$\neg$', '$\vee$', '$\&$', '$\supset$', '$\equiv$', '$\in$', '$\forall$', '$\exists$' for not, or (inclusive), and, if..then, if and only if, is identical with, is a member of, and the universal and existential quantifiers respectively.

Of these, '$\neg$', '$\vee$', '$\forall$' will be regarded as primitives, and the remainder definable in the Peano-Russellean tradition, e.g., '$(A \supset B)$' from '$(\neg A \vee B)$', and '$(\exists x)A$' from '$\neg(\forall x)\neg A$', etc.

iv) The usual formational rules will also be adopted, e.g., "If 'A' is a well-formed formula in $\mathcal{L}$, then so is its negation '$\neg A$', ..."

v) It appears that the only transformational rule we need, if any, at this point is Modus Ponens (MP).

vi) Whatever else required will be introduced either formally or intuitively, as occasion arises.

3.3 Let us now turn to a Predication System. There are at least two ways of formulating a system: one by specification - i.e., specifying all the required elements and the desired modus operandi; the other by assumption - i.e., assuming that all that is required is there, provided that the data pass a certain test (or a battery of tests), and I am going to do a little of both in formulating a predication system here - perhaps more so of the latter.

For our test cases, a simple device of the form 'x is a-P';[38] or simply:

s3.1 x is P

for a test of predication, and of the form

s3.2 (x is P & x is Q)

for copredication should suffice. Let us take the following examples to illustrate the point: i) 'red apple', ii) 'main argument'. The first should appear somewhat thus:

s3.3 (x is Red & x is an-Apple)

or simply

s3.3' (Rx & Ax)

while the second:

s3.4 (x is Main & x is an-Argument)

which can hardly be said to satisfy the well-formedness of a semantic interpretation, and which must, therefore, direct our attention to the necessity of another test procedure - to which we shall return later (cf. also §2.1 - peripheral A) For the moment, let us return to s3.3' '(Rx & Ax)'; how exactly, here one may ask, does the predication or co-predication take place - i.e., in the domain of objects in a certain universe of discourse, how does a certain property coalesce with a certain individual? And this is where the concept of virtual class comes into play.

3.4 Although the notion of virtual classes (or the abstraction theory) has, wittingly or unwittingly, been placed on the center stage recently by the Montague grammarians, it can be traced back to Peano, Frege, and Russell. It was Quine, however, who propounded the theory at length,[39] and other scholars such as Carnap, Church and, especially, R.M. Martin have in recent years made frequent use of the theory. And while Quine, Carnap and Martin are quite consistent in their presentation - and on the whole their interpretations of the idea coincide, the Montagueans - namely, Dowty and McCawley - seem to have brought in something extraneous to the original theory. But this is not the thesis of this study, and we shall ignore the differences for now. It suffices to say that our theory corresponds to the original.

The quintessence of the virtual class concept can be seen clearly in the following situation: suppose we know that Mrs. Jones is a secretary. How does she become a secretary? Obviously, she did something to qualify herself for the position, e.g., she learned to take shorthand, to type up to a certain speed, to do the filing, etc. To *be a secretary is* in fact to be

counted as one among secretaries; in other words, *to be admitted into the class of secretaries*. Indeed, Mrs. Jones is a secretary only by *virtue of the fact* that she has fulfilled certain conditions required of her. In short, x is admitted into a class by virtue of the fact that x has fulfilled the requirements stipulated, formally or informally, for its membership.

It is from this viewpoint that we consider this type of classial entity a virtual class. It is worth noting that Mrs. Jones does not have to born to be a secretary[40] simply because she wants to be one; nor is she obligated to remain one for the rest of her life. She could, for example, go through another professional training, say "nursing", and become a nurse at the end of the training, provided she fulfils the requirements for the profession; in which case she would be, logically speaking, admitted into another virtual class.

It is also worth noting that this type of classial entity is not committed to its membership. Suppose, for example, we have a Japanese professor in the Linguistics Department who wants to offer a Japanese Typology course, say, in the autumn of 1982. The course is announced, and the classroom space allocated. But when the term begins, the Board of Graduate Studies discovers that no student has signed up for it. The class is then cancelled. However, in all the inquiries and replies thereto, that particular class would still be referred to as a class whether it materializes or not. The underlying notion here is not far from what some Montague grammarians talk about in

s3.5 Jane came in to look for friends

in the sense that there is no indication whether the class of Jane's friends has any member - as opposed to "John seeks a unicorn."[41]

For our purposes, we will utilize the notion of the virtual class in this fashion, i.e., "non-committal" - to borrow Quine's term; and it "carries no general presumption of existence of the class."[42]

3.5 Schemtically, the virtual class has been variously represented: Frege, for example, uses a Greek letter with a smooth breathing: '$\grave{\varepsilon}(\varepsilon\ldots)$';[43] while Quine: '$(\hat{x}:Fx)$';[44] and R.M. Martin, following Peano, the inverted epsilon thus: '$x\ni(-x-)$'.[45] Russell, on the other hand, places a circumflex

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over the variable: '$\hat{x}(\phi x)$', which gives the advantage of being able to turn it into a propositional function '$\phi\hat{x}$' or more specifically '$\phi!\hat{x}$'.[46] In this presentation, we shall use the notation currently in vogue, i.e.,

s3.6 $\lambda x(..x..)$

for a virtual class or a one-place abstract, with appropriate restrictions to be stated below. So, for a predicate 'man', for example, we shall write

s3.7 $\lambda x(Mx)$

which reads: "all the entities x such that x bears the property of being a man." And to say that "some individual y is a man," we will indicate

s3.8 $y \in \lambda x(Mx)$

i.e., if we take s3.7 as a virtual class; but if we want to regard s3.7 as a form of a predicate - in this case, a complex one - we shall rewrite s3.8 as follows:

s3.9 $(\lambda x(Mx))y$

with a provision that the parentheses will be thinned down where there is no danger of confusion, e.g., '$\lambda x(Mx)y$', etc. We could also utilize our sentential variables of L, e.g., '$\lambda x(A)y$' when we wish to make a general statement or as a shorthand procedure, where desired.

The above statements, s3.8 and s3.9, clearly show that the schematic expression in s3.6 can function either as a class or predicate symbol mutatis mutandis, of course.

Although it is quite clear at this point that we will not be able to utilize the virtual class theory to the fullest extent in this particular study, it is still necessary to state the restrictions that accompany the use of these schematic expressions - lest it become a source of misconception; hence, the following will be our rules and definitions for Abstraction - one each should suffice here:

D-Abst 1 '$\lambda x(Px)y$' as an abbreviation for

'$(\exists z)(z = y \ \& \ (\exists x)(x = z \ \& \ Px))$'[47]

granted, 'z' must not be free in the sentence represent by 'Px'; but that much is standard convention.

R-Abst 1

$\vdash \lambda x(B)y \quad \dashv\vdash \quad A$, where A and B are any formulas and x is an individual variable not free in A, and B differs from A only in containing free occurrences of x where and only where there are free occurrences of y in A.[48]

We should want, perhaps in future use, our rules and definitions to extend o v e r the cases of two- or more-place abstracts, naturally, with appropriate changes.

3.6 There are obvious advantages[49] in formulating a theory of predication (or copredication) in terms of the Virtual Class or Abstraction theory: first, as we have tacitly shown, it allows us to conflate the notion of class with that of property; second, it allows us to talk about a class as an entity without a commitment to its existence; third, it allows an easy access to complex predicates e.g., consider again the predicate 'man': if we choose to define man as a "rational animal", then instead of stating '$\lambda x(M)$', we can write:

s3.10 $\lambda x(Rx \ \& \ Ax)$

In fact, we might say that s3.10 is the kind of image we want to present in terms of copredication in our analysis, i.e., one individual object - fictive or instantiated - shares a plurality of properties. In English, this plurality basically does not exceed two in number; when it does, of course, it will require a more sophisticated analytic procedure - one that must be presented on another occasion.

Many more advantages from this type of theoretical conceptualization will emerge, if the scope of the paper permits a fuller development. As it stands, we must be content with what possibilities the above enumeration might bring.

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IV The Unsaid

4.1 It would be a miracle of miracles for a topic of this nature to be presented, within the limit of the scope as prescribed, without any shortcomings. There are at least two possible sources of these: one from the involved nature of the subject-matter. The classification and reclassification of the English adjectives, for a semantic analysis as proposed, in itself is a formidable task - i.e., if one wishes to do justice to the subject - let alone its combination and involvement with the nouns. But it would be impossible to talk about a system in which adjectives and nouns are cofunctional with only one or the other element present. And with the prescribed limit on the scope impending on the presentation, the additional task at hand is the selection with a sense of relevancy. Unfortunately, however, the question of "relevancy" is so subjective that the task may fall short of "satisfactory" because of diverging viewpoints.

The other source stems from the formal system itself: to create a formalized metalanguage system with a logical progression, one cannot quicken the pace faster than that of the logical progression itself. And, again, under the same circumstances, one - in a desparate attempt - may resort to the temptation of abbreviatory devices, or the seemingly possible curtailment of logical steps - all of which may, from the reader's standpoint, form a source of perplexity. I certainly hope that this is not the case here.

To be brief, the following list will show what should have been included but for reasons of space and time:

i) Identity Theory
ii) Time Theory and other indexical devices
iii) Boolean classes

4.2 As to the Theory of Identity: one might have noticed that the notion of identity was intuitively utilized in the definition of Abstraction (D-Abst 1). This is because the concept itself is so self-evident - as most scholars claim[50] - that we can borrow and use it without having to define it beforehand - at this stage, at any rate; yet, as Quine puts it, "despite its simplicity, identity invites confusion."[51] Consequently, most scholars are forced to define it in

some form, at some point, or another in their theory, especially when it is to be applied to entities other than individual constants, or variables. To derive a full (or fuller) benefit from the Abstraction theory, we should at least introduce some interrelationships of Identity. For example, we may at some stage be forced to make a statement about the identity of two virtual classes, such as

4.1 $\lambda x(A) = \lambda y(B)$

e.g., the class of "the passengers of the first voyage of the Mayflower" is identical to the class of "the founders of Plymouth (Massachusetts)." And it would be difficult to do so without any preliminary statements about the nature of identity. In fact, from a theoretical viewpoint, the proofs of many virtual class theorems depend on the Theory of Identity.

4.3 A time theory and other indexical procedures: our theory, as has been shown briefly, requires a device by which a variety of indices - temporal or otherwise - could be applied. For temporal indices, the simplest way is to formulate the time theory in terms of a discrete, relative time-flow system, as proposed by Woodger and Martin,[52] in which the time-flow is - perhaps only heuristically - reduced to "stretches", "segments" and "discrete moments" of time relative to each other. For example, time t_1 can be said to be prior to (or wholly before) t_2; and t_3 an overlapping period of t_1 and t_2, etc. Once all the interrelations among these segments are worked out, it is not difficult to approximate them to the English tenses.

A time system of this kind is much easier to handle than one that divides the whole universe into different temporal worlds, e.g., the world of the past, present, and the future, etc., as Prior, Cocchiarella, and others have proposed.[53] For one thing, if time becomes an insignificant feature in a particular statement, then in the above system the indices could be dropped, and the notion of time "ignored" or "left out as being understood" in much the same way as the notion of time operates in natural languages. While in the other system, once time becomes a fixed entity, it must be accounted for at all times.

If the proposed time marking sytem is adopted, then, together with a two-place predicate which we will quickly introduce intuitively here, we can demonstrate - in a glimpse, perhaps - the structural differences between the

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gradable and the scalar adjectives.

'€' will indicate a comparative relation of the type "(more-A) than".[54] So, to say that "John is fatter than Mary" - which is a gradable adjective here - is in fact to say that - to put it in a general form:

s4.2 x is more-A than y is A

With the newly introduced predicate, we could restate s4.2 - using a predicate 'P' for A - more simply and accurately thus:

s4.3 $€<Px, Py>_{t_i}$

where t_i = the time of utterance.

With this kind of a two-place predicate, we can see a necessity for an ordered-pair (or n-tuple) form of statement. In demonstrating the structure of the scalar adjectives, we will, for convenience, transfer the temporal indices from the t's to the predicates themselves - also, for added clarity, we will enclose the individual variables in parentheses:

s4.4 $€<P^A_i(x), P^A_j(x)>$

where 'i' and 'j' are time parameters, and 'i' is prior to 'j' as well as to the time of utterance, and the superscript 'A' indicates that the predicate is of an adjective source - cf. infra.

Here, the two underlying structures are clearly indicated, recalling that the scalar adjectives are also reflexive.

The indexical system can get quite elaborate, if we allow it to run its course; for example, we all know that other word-classes can also take the comparative form. But even if we confine ourselves within the area of our interest here, we get statements such as "He is more of a brother to me than a friend." Here, not only do we get the change in the type of predicate - i.e., from 'P^A_i' to '$P^{N'}_i$' (cf. supra), but in the predicate itself. The situation is worse in the following statement: "He used to be more of a father to me than a husband..." Here we get the time indices added on to as well. Of course, the comparative degree can run up and down the scale as it pleases, e.g., "He used to be less of a husband to me than he is now," etc.

Other indexical devices, such as the method of "predicate description" in the manner of Frege's *Art des Gegebenseins*[55] as frequently utilized by

Martin and Davidson (as demonstrated in my preliminary version), could also be introduced for various purposes.

4.4 The need for the above two items may be transparent enough, but the need for the Boolean classes may be obviated by the feeling that these are items of theoretical extravaganza. Consider the following statements, however,:

s4.5 Teachers are educationists
s4.6 Mammals are mortal
s4.7 Patience is a virtue
s4.8 Man is a species

From an extensional viewpoint, and with the limited tool we have, we could interpret s4.5 as an identity statement, e.g.,

s4.5' $\lambda xA = \lambda yB$

i.e., the class of "teachers" is identical to that of "educationists." But this would be inaccurate, since it implies that "all educationists are teachers." The same applies to s4.6. Schematically, however, s4.7 could probably be represented thus:

s4.7' $(\forall z)(\lambda x(Px)z \rightarrow \lambda x(\forall x)z)$

and the back-translation may appear: "If anything is patient, then it is virtuous."

The obliqueness, or periphrasis, in translation, however, does not affect the sense of the sentence as much as it would in s4.8, e.g.,

s4.8' $(\forall x)(\lambda y(My)x \leftrightarrow \lambda z(Sz)x)$

i.e., "If anything is a man, then it is a species, and conversely," which is not the case at all; nor is this sense intended in the original.

If we, indeed, had access to the Boolean algebra, we could formulate s4.5 schematically thus:

s4.5" $\alpha \subset \beta$

i.e., the class of "teachers" is included in the class of "educationists."[56] A precise underlying structure of s4.8 is a little more subtle and may be given as follows:

s4.8" $\alpha \subseteq \alpha\delta$

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that is, "the class of man is included in an intersection of itself with a class of those that form a species." There are many living objects that can form species; but this intersection contains only those that belong to the class of man.

Indeed, the Boolean classes (or functions) would have added clarity and precision to our system, even as small as it has been intended. The transition between the two concepts of classes - i.e., the definitions which link the Boolean with the virtual class - alone would have served the reader with a greater insight into the interrelationships between class and predicate.

4.5 One could, of course, go on suggesting other formal concepts which would render clarity to semantic notions and relations; but semantic problems are, unlike the Rubic-cube tricks, genuinely complex in nature and extensive in scope - so much so, that one can keep on adding to the list *ad infinitum* and still leave the problems staring at one in the face.

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NOTES

[N.B.: Apart from the commonly accepted abbreviations, the following (from the Library of Congress list) will be adopted, for convenience:

'x' for "see" (< cross-reference)

'xx' " "see also"

All the references given in full in the Notes will not be repeated in the Bibliography.]

1 Quirk, et al (1972), p. 247; it will generally be referred to as "Quirk".

2 Historical Linguistics, New York, Holt, 1962; p. 196.

3 (1977), p. 147ff.

4 (1947), p. 251f.; Reichenbach feels that adjectives should be put "on a par with a tense of a verb."

5 For the history of adjectives as a word-class, x Lyons (1969), p. 6ff; Robins (1979), Chs II, III, et passim.

6 Montague (1974), p. 243, et passim.

7 x Keenan (1975) p. 123ff. It is difficult to know how much influence Montague had on Kamp's work, since he was one of Montague's students; at the same time Montague acknowledged Kamp's criticism on his works even before Kamp's paper was published.

8 x Thomason's remarks in his introduction to Montague (1974).

9 P. 147

10 P. 95f.

11 P. 154f; italics mine.

12 Loc.cit; italics mine

13 This is one of the reasons we feel that a formalized metalinguistic system would present ideas more clearly.

14 For Quine, op.cit., p. 96f; Hodges, op.cit., p. 57, and 210ff.

15 Op.cit., p. 251; italics mine.

16 Loc.cit.

17 P. 79.

18 P. 96.

19 Any standard text in symbolic logic would reflect this attitude; Quine (1970) concurs - x p. 22f.

20 Op.cit., p. 234.

21 Op.cit., see articles concerned.

22 P. 15.

23 It is not the intention of this study to give a listing of all the adjectives; each classification within the schema will give some examples

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24 This symbol, which would always be underlined, is not to be confused with 'A, B, C, ...' to be introduced later as sentential variables in our formal system.

25 (Deleted)

26 There is still a hitch here; the problem is similar to the case of 'a famous pianist' - cf. infra.

27 Except in the case of "lively student"; but I am not sure if he means the same as what I mean. For data, x p. 266, op.cit.

28 The notion of "dependency" - however one interprets it - is not very far from that used in the Dependency Grammar; but I have no wish to get tangled up in the web of technicalities, if any, at this point. The idea as proposed here is not far from what P.H. Matthews (1981) describes, including the terms "head" and "modifier" - p. 78ff.

29 From a semantic viewpoint, the notion could be presented in terms of semntic focus; but the scope of this paper precludes it.

30 (1975), Chs. I, II; it is not very likely that we will have a great deal to do with work of this kind, although it would be interesting to compare his formulation of '(x:φx)' with Quine's '(x:Fx)' - x (1960), p. 15ff.

31 For Thomason, x Montague (1974),"Introduction"; Martin (1979), p. 160ff; Hintikka - x Kooner (1976), p. 208ff.

32 Some formalists prefer a notation such as '$t_i < t_j$' - where 'i' is smaller than, or prior to, 'j'.

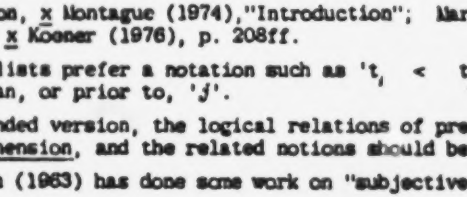
33 In an extended version, the logical relations of predicative subsumption and comprehension, and the related notions should be stated.

34 R.M. Martin (1963) has done some work on "subjective quasi-intensions" - p. 79ff.

35 We will concern ourselves here with English only.

36 In all likelihood, we are overspecifying in the present study.

37 These sentential variables, or schematic symbols, should always be thought of as having the following underlying structure:



38 Kamp (cf. supra) claims that this procedure is no longer in use; however, cf. Montague (1974), p. 213 - when he wrote

'v_0 is a horse'

where 'v_0' is a variable.

This type of structure also appears elsewhere in Montague's works; xx Quine (1960) and his other works - passim.

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39 In his System of Logistic (Cambridge, Mass., 1934), p. 48ff; in his Brazilian lectures: O Sentido da Nova Lógica (1942), published by Martins in São Paulo, 1944, he elaborated the idea, and in his (1969) he departed somewhat from his original formulation.

40 At one point, scholars divided classes into "real-" and "pseudo-classes"; and a typical example of the real class is a class of "mothers", "fathers", of "ancestries", etc. Indeed, one cannot become a mother just in the same way as one can a secretary; it involves a physical transformation, etc. But this is a highly explosive material, and we should stay clear from it as far as possible.

41 Regardless of Bennett's claim - i.e., there are two readings of this statement - we all know that there are no unicorns; x Partee (1976), p.142.

42 Quine (1969), p. 35.

43 During Frege's time, it was ambiguously called the "graph of function..." - x Geach et al (1952), Ch I; xx Kneale and Kneale, The Development of Logic, Oxford, Oxford UP, 1962, p. 503ff.

44 (1963,1969), p. 16; Quine's notation is pretty close to the form used in set theory, and is now widespread among mathematicians. P.H. Matthews in his Inflectional Morphology (Cambridge, 1972), incidentally, uses:

$$\{z|(z\ R\ w).(w\ B\ l).(l \in VERS)\}$$

for "the set of word-form z ..." (x Ch 9); the underlying idea is not far from what Quine and other scholars are talking about, except that this particular use is intended to be that of a "set".

45 (1958), p. 49ff, and subsequent works. Martin has been known to use other forms, e.g., '$\hat{x}(..x..)$'; and - perhaps, only once - '$\lambda x(..x..)$' in his (1978).

46 In Principia Mathematica, commonly known as PM, p23ff, and *20.

47 In §3.2, we stated that all the conventions for the classical two-valued logic would be adopted for this study; that in effect would include the stratificational procedure, and would insure our system against any intrusion of antinomies. The three-variable convention, following Quine, is introduced here, however, only as a double precaution; xx Quine (1969), p. 17ff.

48 The simplest way to read this rule is to translate it back into the predicate form, e.g.:

$$\vdash \quad \lambda x(Px)y \quad \leftrightarrow \quad Py, \ \ldots$$

We should, of course, allow this rule to apply to individual constants as well; xx Martin (1963), p. 10f, or (1958), p. 59ff.

49 (Deleted)

50 x Copi (1979), p. 140ff; Quine (1974), p. 221.

51 Loc.cit.; compare also the following statement: "Joan and Veronica are wearing identical dresses," or "My dear Mary! This is the exact identical dress that Miss America was wearing last night."

•52 Woodger (1939), p. 32ff; Martin (1963), p. 40ff.

53 x Bibliography

54 Strictly speaking, it should be "(more-A-than-A) than", since in terms of a numerical analysis, the comparative degree would be approximated to the '(n + n)-type', e.g., "fatter" would be (fat + fat), hence the statement should read:

"x is more-A-than-A than y is A"

but such pedantry may taint probity.

55 Geach and Black translates this as "mode of presentation" - Geach (1980), p. ix; while Martin as "mode of linguistic description" - Martin (1981), p. 8.

56 The virtual-class inclusion is usually defined in terms of a predicate inclusion, which we did not have time for.

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